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A Brake for Turtles: Empowering the Community with Knowledge Can Help Reduce Vehicle–Turtle Collisions

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Abstract

Urbanization is widely studied as a major cause of wildlife decline. Turtles are among the most concerning species in urbanized areas, largely due to vehicle collisions significantly reducing population sizes. The Chicagoland area is a prime example of an urban–nature preserve patchwork landscape, which simultaneously protects species, and allows for greater human–wildlife conflict. Using personal observations as well as data from the Willowbrook Wildlife Center in Glen Ellyn, Illinois, I address the magnitude of vehicle–turtle collisions around an area in DuPage County. The intent is to provide knowledge so that readers may be able to identify areas of particular concern in their area. This type of awareness may help reduce the number of collisions in urbanized landscapes in the future. Also included are conservation efforts that can be implemented in the community to help preserve turtle species in Illinois.

Introduction

Urbanization Effects on Turtles

As the human population expands, there is a greater need for housing and transportation services. Natural lands are not only completely demolished, but the pockets of natural areas left are often divided (i.e., fragmented) by roads, railways or housing developments. This expansion of human-controlled land is known as urbanization, and while habitat loss undoubtedly causes species decline, fragmentation of remaining natural areas exacerbates the issue. Fragmentation creates dangerous impasses for species, like turtles, that are not equipped physically or behaviorally to navigate across man-made structures (Jochimsen et al., 2004). A direct effect of fragmentation on turtle populations is simply collisions that occur on transportation systems. Vehicle–turtle collisions have been well studied in North America, indicating it is a significant issue for turtle population success (Aresco, 2005; Gibbs and Shriver, 2002). A specific example of this comes from a 2003–2010 study at the Wildlife Medical Center in Urbana, Illinois, which found that 36.5% (73 out of 200) turtles received at the center had been hit by vehicles. This turned out to be the number one reason why turtles were brought in for treatment, and the survival rate was only 34.24% (Rivas et al., 2014). An indirect effect of fragmentation on turtle populations takes into account the unfortunate finding that female turtles, who generally travel further than males, are more likely to be struck by cars, which could aggravate population decline if too many of one gender are removed (Steen et al., 2006).

Turtle Movement and Landscape Features

Observations worldwide indicate many turtle species are at risk or already in decline due to habitat loss and fragmentation (Colino-Rabanal and Lizana, 2012). To help mitigate further species decline, it is important to understand turtle behavior and movement as it relates to the seasons and local landscape features. This will help biologists and community members identify areas of increased risk for collisions.

Seasonal movement of turtles has been widely observed with consensus that the active season is between May and October, and the mating season is between May and July. Observations of wild turtles (specifically the endangered Blanding's turtles, *Emydoidea blandingii*, false map turtles, *Graptemys pseudogeographica*, and slider turtles, *Trachemys scripta*) have found that during mating season turtles travel much greater distances to find ideal mates and nesting habitats compared to the rest of the active season when they generally settle down for the hot summer months (Millar and Blouin-Demers, 2011; Bodie and Semlitsch, 2000). Unfortunately, most urbanized landscapes are not conducive to easy movement. Hotspot areas for vehicle–turtle collisions are linked to landscapes where local turtle abundance is high, and to regions close to water, forest cover, or on causeways (roads that span across wetland type landscapes) (Colino-Rabanal and Lizana, 2012).

Study Details and Purpose

The purpose of my study was to investigate the extent of vehicle–turtle collisions in an area of DuPage County. Results will help bring to light this issue, and assist communities and biologists to determine how their seasons and landscape features may impact turtle populations near them, and where to focus their conservation efforts. Also included (see Appendix) is an example of a survey that could reveal the level of community awareness of vehicle–turtle collisions, and indicate where support lies in regards to prospective conservation tactics. This type of information could be very beneficial to determine the best course of action in the community, whether efforts should be in creating more educational opportunities, or if the community is willing to participate or use tax dollars to implement other forms of conservation strategies.

The study site chosen is an example of a typical urbanized area in Chicagoland. The four-mile stretch of Butterfield Road passes through Wheaton and Winfield, Illinois, and runs along five major DuPage County Forest Preserves, a large neighborhood, a parcel of farmland, and a golf course. A Google Earth map in satellite view gives a visual (Figure 1). The five Forest Preserves of DuPage County in question have a variety of woodland, wetland and grassland habitats which are homes for species including: common snapping turtles, *Chelydra serpentina*; pond sliders, *Trachemys scripta*; painted turtles, *Chrysemys*

Figure 1. Four miles of Butterfield Road including five surrounding forest preserves, farmland, a suburban neighborhood, and a golf course. Google Earth satellite view.

picta; endangered Blanding's turtles, *Emydoidea blandingii*; common musk turtles, *Sternotherus odoratus* (Illinois Natural History Survey, n.d.).

Methods

Observational data were collected on 10 occasions, roughly once per week from 25 June 2018 to 1 October 2018 around 10 A.M.. The data were collected by driving slow on both sides of the present median on Butterfield Road, which maintains relatively high traffic volumes at 45 mph. All turtles (dead or alive) were recorded in the roadway, including the size and whether they were on the north or south side. If roadkill was not immediately identifiable, the shoulder was used to stop and walk to the location. Additionally, data were obtained in November, 2018, from the Willowbrook Wildlife Center which summarized the types of injury sustained by turtles received by the center in 2018 (Table 1). Two articles (FitzGibbon and Jones, 2006; Harris and Goldingay, 2003) were used as models for a potential survey for the community.

Table 1. Data obtained from Willowbrook Wildlife Center regarding number of turtles received and injuries sustained.

Turtles brought to Willowbrook with:	Number	% of total (113)
Collision injuries	49	43.34%
Other injuries	40	35.40%
Unknown cause of injuries	64	56.64%

Results

Eight turtles were found on the four-mile stretch between 25 June 2018 and 11 July 2018, all deceased and unidentifiable. Seven more observations throughout the end of summer and into fall yielded zero observations. Locations of the turtles found are shown in Figure 2.

Willowbrook Wildlife Center data revealed that 76 out of 113 turtles received between 25 February 2018 and 29 October 2018 were between 2 May and 31 July. Based on the total number of turtles, 56.64% came in with unknown cause of injury, 43.34% had collision-based injuries, and 35.40% had other injuries such as animal attacks, fishing related injuries, or other human interference. The majority of turtles brought in with collision-based injuries had fractured shells or other fractured body parts. Unknown injuries often included dehydration and trauma to shell or other body parts. The survey for potential future distribution is on Table 2.

Discussion

Seasonality and Landscape Features

Observational data taken from the roadway as well as data received from the Willowbrook Wildlife Center indicate a seasonal pattern to vehicle–turtle collisions in this area, which largely correlates to mating season when turtle traffic is highest.

Figure 2. Eight data points reflecting vehicle–turtle collisions. Centermost icon represents two turtles. Google Earth satellite view.

Concerning landscape features, looking at the topography of the four miles of Butterfield Road, it was estimated that the largest number of turtles (three) was found closest to the recently restored wetland in Danada Forest Preserve followed by two near the agricultural fields, two near the golf course and one by the pond at Herrick Lake (Figure 2). As illustrated by Bodie and Semlitch (2000), there are also seasonal patterns in turtle movement in regard to habitat usage that are likely related to seasonal wet and dry conditions. These researchers observed that turtles (false map and slider species) in central Missouri near the Missouri River more regularly frequented agricultural fields and young forests between April and July. This could be because spring often causes flooding, and it is safer for turtles to reside in areas of shallow flooding. Turtles observed during the rest of the active season months were typically found in wetlands, near rivers, and around scours (habitat formed by accumulating debris in moving water).

Mitigation Techniques

Several actions could be taken in this area to reduce turtle road mortality. Ecopassages are often used to give animals safe alternative travel routes. A study of newly installed culverts on a highway in California found that snake and turtle species did utilize these routes, which significantly aided the recovery of unstable population levels (Jochimsen et al., 2004). However, Baxter-Gilbert et al. (2015) found that ecopassages in Ontario, Canada, along with fencing along a highway did not decrease turtle crossings on roads, and in fact increased turtle crossings by 20%, when compared to a highway with no conservation tools. This shows that reptile ecopassages are tricky, and expensive, so implementing this type of conservation tool may not be feasible for Butterfield Road. Fencing may work, and has been shown to be effective (Aresco, 2005), but could also end up being costly, and may aggravate habitat fragmentation even further. A final, less expensive option that is a good candidate for implementation on Butterfield Road is signage. Specifically, temporal signage (May–July) would urge drivers to be on the lookout for crossing turtles, whereas permanent signage would eventually cause desensitization (Beaudry et al., 2010).

Community Participation

A great way to help conserve species in the community is by involving the community. As previously discussed, implementation of a survey like the one outlined in the Appendix to this paper can help gain knowledge from the public on what they know about particular topics. Many of the potential questions are open-ended, requiring the community to share sightings of turtles in their community, especially prompting them to share when and where they saw turtles in the roadway. Gathering of information this way, through citizen science, allows for scientists and activists to get far more data than if they were to conduct a study independently (Tulloch et al., 2013).

Surveys can also indicate if educational programs would be beneficial; for example, an informational session on how to safely and effectively help turtles cross the road. University of Illinois Extension (n.d.) discusses this topic, bringing up many facts about turtles that the general public may not know. For instance not relocating a turtle too far from where it was found, and moving it in the same direction of travel. Moving it too far, or moving it to a location they were not intending to go only causes the turtle to return on its original trajectory.

Finally, surveys can also be fruitful in ascertaining where public support lies. Conservation techniques involve erecting fencing, signage, allocating additional money towards restoring habitat, or increasing educational seminars, and surveys can reveal which conservation tools to emphasize. Whatever conservation technique is implemented, it is clear that Butterfield Road in DuPage County, Illinois, should continue to be addressed in regards to its turtle mortality, and further studies such as this could greatly help the conservation of turtle species in the Chicagoland area.

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Appendix: Potential Survey for DuPage County Residents

1. In what town in DuPage County do you reside?
2. Have you ever seen a turtle in your town?
   ☐ Yes
   ☐ No
   ☐ Unsure
3. How often do you see turtles in your area?
   ☐ Daily
   ☐ Weekly
   ☐ Monthly
   ☐ Quarterly
   ☐ Yearly
   ☐ Occasionally
   ☐ Never
4. Do you have any memories of locations or dates (approximate) of where you saw a turtle in your town? (please elaborate in space below)
5. Have you ever seen any dead turtles in your town?
   ☐ Yes
   ☐ No
   ☐ Unsure
   (Do you wish to elaborate on this response in space below?)
6. Do you believe that the long-term survival of turtle species in your community is threatened by any of these?
   Roads and traffic [yes / no]
   Housing developments [yes / no]
   Dogs and cats [yes / no]
   Wild predators (foxes / coyotes) [yes / no]
   Other (please specify in space below)
7. If it were deemed necessary to address turtle and human interactions in your community, would you support any of the following conservation actions to be taken to protect turtle species?
   Public efforts to monitor roadways during turtle migration season (May–July) [yes / no]
   Erecting non-permanent traffic signs during turtle migration season (May–July) [yes / no]
   Erecting permanent traffic signs on roadways where vehicle–turtle collisions are high [yes / no]
   Using public money to continue restoring native wildlife habitat [yes / no]
   Other suggestions (please specify in space below)
8. Do you have any additional comments about turtles in DuPage County or turtle conservation? (please specify in space below)

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New Country and State Records for *Indotyphlops braminus* (Serpentes: Typhlopidae). Part II

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Abstract

The establishment of *Indotyphlops* for the species previously known as *Ramphotyphlops braminus* is discussed. A brief synopsis of the current distribution of *I. braminus* is given, followed by an appeal for reporting observations of the flowerpot snake via social media and online databases. New and unrecognized distribution records for certain countries and a few American and Mexican states for *I. braminus* are reviewed. They are mainly based on social media and internet postings with a few obscurely published reports and museum records. Unconfirmed records are identified and also discussed.

Introduction

This is the second in a hopefully continuing series on the never-ending expansion of the geographical range of the flowerpot snake or Brahminy blindsnake (Wallach, 2008), whose correct generic placement is now in *Indotyphlops* based on a recent molecular study by Hedges et al. (2014), which divided up the genus *Typhlops* into nine genera (*Amerotyphlops*, *Antillotyphlops*, *Asiatyphlops* [now = *Argyrophis*], *Cubatyphlops*, *Indotyphlops*, *Madatyphlops*, *Malayotyphlops*, *Typhlops* and *Xerotyphlops*). Formerly known as *Typhlops braminus*, then *Ramphotyphlops braminus*, with a brief tenure as *Typhlina bramina*, it is now properly referred to as *Indotyphlops braminus* (Daudin, 1803). This little 4–5 inch (100–130 mm) snake is the smallest snake in every country around the world where it is found, except in Sri Lanka and India (where the closely related *Indotyphlops pammeces* species group occurs, most of which are smaller than *I. braminus*). It is the smallest and most widely distributed vertebrate in the world (Grace and Grace, 2015). Because it is very small (even tiny), fossorial or semifossorial in habit, and nocturnal in nature, it is rarely seen on the surface except after heavy rains, which force *I. braminus* to come up for air. The majority of specimens are uncovered while digging, raking through gardens or detritus, or turning stones. They also have an affinity for domestic enclosures, perhaps in their pursuit of termites and ants, and can be found inside homes.

It has perfected the art of being an international invasive species, stowing away in soil and hitchhiking around the world with commercial plants. Previously recorded from 29 (Werner, 1921), 51 (Hahn, 1980), 53 (McDiarmid et al., 1999), 59 (Kraus, 2009), and 84 (Stuart et al., 2014; Leets-Rodríguez et al., 2019) countries, it has now dispersed to at least 118 countries and entities (island territories). The natural range of *Indotyphlops braminus* is considered to be southern and southeastern Asia from Pakistan to China and southward throughout Indonesia. It appears to be a native of 18 Asian countries and it is debatable whether it is native or has been introduced to Taiwan and the Philippines. Besides those 20 "native" countries it has now spread to another 100 entities. In the 110 years from 1790 to 1899 it was known from 38 countries; during the next 90 years (until 1988) it was discovered in another 31 countries; in the past 30 years it has been observed, photographed, or collected in an additional 118 countries.

An alphabetical list of those countries and island territories that have reported the presence of *Indotyphlops braminus* on at least one occasion follows. Establishment of a colony is not guaranteed by a single observation but it is certainly a possibility and likely a probability. Countries include: Afghanistan, Australia, Bahrain, Bangladesh, Belize, Benin, Bhutan, Burkina Faso, Burundi, Cameroon, Central African Republic, China, Congo-Brazzaville (PRC), Congo-Kinshasa (DRC), Costa Rica, Cuba, Dutch Leeward Antilles, Dutch Windward Antilles, East Malaysia, Egypt, El Salvador, Equatorial Guinea, Gabon, Guatemala, Honduras, Hong Kong, India, Indonesia, Iran, Iraq, Italy, Ivory Coast, Japan, Kampuchea (Cambodia), Kenya, Kuwait, Laos, Libya, Madagascar, Mauritania, Mexico, Micronesia, Morocco. Mozambique, Myanmar (Burma), Nepal, Nicaragua, Nigeria, Oman, Pakistan, Palestine, Panama, Papua New Guinea, Philippines, Portugal, Qatar, Saudi Arabia, Senegal, Singapore, Somalia, South Africa, Spain, Sri Lanka, Taiwan, Tanzania, Thailand, Togo, United Arab Emirates, U.S.A., Vietnam, and Zambia. Island countries and territories include: American Samoa, Andaman & Nicobar Islands, Anguilla, Bahama Islands, Balearic Islands, Barbados, Canary Islands, Cape Verde Islands, Cayman Islands, Christmas Island, Cocos/Keeling Islands, Comoro Islands, Diego Garcia, Fiji, French Antilles, French Polynesia, Grenada, Guam, Kiribati, Laccadive Islands, Loyalty Islands, Macao, Maldive Islands, Mariana Islands, Marshall Islands, Mascarene Islands, Midway, Montserrat, Nauru, New Caledonia, New Zealand, Palau, Puerto Rico, Scattered Isles, Solomon Islands, Seychelles, St. Kitts & Nevis, St. Vincent & Grenadines, Timor-Leste, Turks & Caicos, U.S. Virgin Islands, Vanuatu, Western Samoa, Wallis & Futuna, and Zanzibar.

The significant increase in knowledge about the distribution of *I. braminus* is partly due to environmental awareness and, of course, smartphones and social media. It undoubtedly occurs in many areas of which we are not yet aware (including new countries and islands) as it may be mistaken for a worm by the layman and, even if recognized as a snake, finding one may not be considered an important event. Hence, many finds go unreported and the specimens are not collected. All instances of observations of *I. braminus* should be documented or reported. Today it is not necessary to collect and preserve the snake for documentation: a decent photograph (along with GPS data) is enough verification for a voucher. There are numerous online sites that

accept photo documentation of specimens (e.g., CA Atlas, EDDmapS, EOL, HERP, HerpMapper, iNaturalist, iSpot, Project Noah). An important point to remember is that, since *I. braminus* is a parthenogenetic, all-female species, every single individual has the potential to start a new colony or population. This is why I consider every specimen record to be indicative of an established breeding population. Each snake produces 1–8 ($\bar{x}$ = 3) eggs and reproduces once seasonally or biennially (in higher latitudes or elevations) and continuously throughout the year (in lowland tropical regions) (Nussbaum, 1980; Ota et al., 1991; Kamosawa and Ota, 1996) so that a colony can grow quite quickly.

In the continental USA, *Indotyphlops braminus* first appeared in south Florida during the 1970s (Wilson and Porras, 1983). Since then it has made an appearance in 15 other states so that with the addition of Hawaii, where it was first discovered in 1930 (Slevin, 1930), it is now known from Alabama, Arizona, California, District of Columbia, Florida, Georgia, Hawaii, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, North Carolina, Ohio, South Carolina, Texas, and Virginia (two of the former are reported herein). On a worldwide basis, *I. braminus* is now known to occur on 543 islands and islets, with 93 islands in Japan, 63 in the Philippines, and 58 in Indonesia. Less numerous island occurrences include Hong Kong (24), USA (24), Seychelles (22), West Malaysia (16), Mascarenes (13), Palau (13), South Solomons (13), and Marianas (10).

Data on elevation is not as useful with *Indotyphlops braminus* as it is with other snakes in determining its ecology, evolution and distribution because it did not naturally migrate to its inhabitations; it has basically invaded new areas as a stowaway in plant soil. Nonetheless, it can survive at high elevations as seen by the following nine countries with maximum elevation records above 2000 m: Hawaii (USA)—3049 m, India—2907 m, Nepal—2805 m, Saudi Arabia—2637 m, Mexico—2620 m, Papua New Guinea—2588 m, Bhutan—2427 m, China—2165 m, and Indonesia—2090 m. Likewise, there are at least a dozen countries from which the maximum known elevation is less than 10 m. Since *I. braminus* can occur anywhere tropical or ornamental plants are distributed, its elevation is limited to the geography of that country.

Several institutional collections are abbreviated below: ZFMK = Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; IRD = Institut de Recherche pour le Développement, Dakar, Senegal; MMNS = Mississippi Museum of Natural Science, Jackson, Mississippi.

New Country Records

Some of the following cases have been published or posted online but they are being reproduced here because they may have been overlooked and there is a need for a more permanent record.

BELIZE: Belize District: between Hattieville and Rockville, photographed by J. Meerman on 14 May 2005; Cayo District: San José Succotz: Belize Maya Tours, J. Meerman on 21 October 2009; Cayo District: Green Hills Butterfly Ranch, J. Meerman on 13 February 2010 (posted on iNaturalist on 13 January 2020).

BURUNDI: Bujumbura Province: Mont Sion Gikungu, 890 m elevation, collected by Tom Kirschey on 4 December 2013 (ZFMK 96318).

CHAGOS ARCHIPELAGO: Diego Garcia (NAVFAC, 2005).

COSTA RICA: Guanacaste Province: Playa Langosta, photographed by Steve Page on 4 December 2018 (posted on Facebook); Guanacaste Province: Santa Cruz, photographed by "buduncky" on 22 March 2020 (posted on NaturaLista on 24 March 2020).

DEMOCRATIC REPUBLIC OF THE CONGO: Kinshasa Province: Congo River: near Stanley Pool, collected by Franck Nsingi in 2017 (IRD TR.413-14) (Trape, 2019).

MOROCCO: Guelmin: Es-Semara Prefecture: Assa-Zag Province, no specific locality, photographed by Tammy Bush on 27 April 2019 (posted on HerpMapper [HM 266390] on 27 April 2018).

PALESTINE: Gaza Strip: Wadi Gaza Nature Reserve, collected on November 2002, deposited in Dept. of Biology, Islamic Univ. of Gaza (Yassin et al., 2006).

PANAMA: Coclé Province: Agua Dulce: Avenida Abelardo Herrera, photographed by "labster341nrpg" on 29 October 2018 (posted on iNaturalist on 24 November 2018).

PUERTO RICO: San Juan Province: Guaynabo, photographed by José Carro on 21 July 2013 (posted on Flickr).

QATAR: photograph of two Flowerpot Snakes (dated 21 March 2015) posted on Qatar *e*-Nature website < https://www.enature.qa/specie/flowerpot-snake/>.

SCATTERED ISLES: Europa Island, specimen found by a Météo France service agent in 1994 with a plant imported from La Réunion (Probst, 1998).

U.S. VIRGIN ISLANDS: St. Croix District: Northwest Subdistrict: Carambola Beach Resort, collected by Stephen R. Goldberg on 15 March 2017 (LACM 188634); St. Thomas District: Tutu Subdistrict: Saint Thomas: no specific locality, photographed by Noah Mueller on 16 May 2013 (posted on HerpMapper [HM 124174] on 23 February 2016).

WALLIS & FUTUNA: Wallis Island, collected by Ivan Ineich in October 2013 (Ineich, 2016).

ZAMBIA: Northwest: Lusaka: Mimosa Road (15°31'27.54"S, 28°15'34.27"E), photographed by Andrew P. Dekker, 10 February 2020. A second record is from Kalumbila Woodlands Estate, photographed by Sarah Magrath, 22 February 2020 (posted on Facebook by photographers).

New State Records

The following Mexican and American states have reported cases of *Indotyphlops braminus* since 2010.

MEXICO: COAHUILA DE ZARAGOZA: Saltillo: República 25280, photographed by "arturoc" on 6 August 2016 (posted on NaturaLista on 8 August 2016); Saltillo, photographed by "monicaorna" on 25 October 2016 (posted on NaturaLista on 6

December 2016).

MEXICO: COLIMA: Manzanillo: La Joya: Calle Andrómeda, photographed by "alberto298" on 20 October 2019 (posted on iNaturalist on 20 October 2019).

MEXICO: GUANAJUATO: Irapuato: Las Fuentes, photographed by "ricardo125" on 14 June 2018 (posted on iNaturalist on 10 January 2019); Callejón Piletas 8, photographed by "lavinia_lavin" on 23 July 2018 (posted on iNaturalist on 25 July 2018).

USA: ALABAMA: Baldwin County: JSU student flowerbed and Mobile County: Theodore (cited by Mitchell, 2017); Baldwin County: Ono Island: Ono North Recreation Center, photographed by "treytonjohnson1" on 15 October 2019 (posted on iNaturalist on 11 March 2020); Baldwin County: Pensacola (Bronson Field, Naval Outlying Landing Field) (Petersen et al., 2017).

USA: DISTRICT OF COLUMBIA: D.C. County: Washington: National Zoo: Reptile House, observed by Dr. James B. Murphy prior to 2015 (Murphy, 2015); D.C. County: photographed by Michael Kirby on 2 May 2016 and reported that others have also found *I. braminus* in D.C. (posted on H.E.R.P. on 2 May 2016).

USA: GEORGIA: Dougherty and Wayne counties (cited by Jensen et al., 2008: 525); Tift County: Tifton: 702 12th Street, Karan Rawlins on 1 November 2014 (posted on EDDMapS [ID #8315034] on 10 February 2020); Seminole County: locality unknown, photographed by Gabrielle Townsend on 13 May 2018 (posted on HerpMapper [HM 219913] on 13 May 2018); Chatham County: Savannah: Habersham St. at East 39th Street, photographed on 21 October 2019 by "jjmontem" (posted on iNaturalist on 21 October 2019).

USA: MARYLAND: Howard County: Ellicott City: David W. Force Park, photographed by "Carly H." on 2 September 2018 (posted on HerpMapper [HM 239347] on 2 September 2018).

USA: MISSISSIPPI: Jackson County: Jackson: florist shop, collected February 2020 (MMNS uncatalogued).

USA: SOUTH CAROLINA: Charleston County: Isle of Palms: 705 Ocean Blvd., photographed by "macie91924" on 14 August 2017 (posted on iNaturalist on 14 August 2017).

Unconfirmed and Erroneous Country Reports

The following countries have been listed for *Indotyphlops braminus* without verification.

ARGENTINA. First listed by Loveridge (1957) and subsequently by Kraus (2009), Mateo (2013), GISD (2010), and Anonymous (2014), but unconfirmed.

ARU ISLANDS (Indonesia). First listed by Barbour (1912) and followed by Rooij (1917) and Werner (1921). However, presence questioned by McDowell (1974) and McDiarmid et al. (1999), but then listed as present by Hahn (1980), Iskandar and Colijn (2001), Wallach (2009), Mateo (2013), Wallach et al. (2014), Animalia website <http://animalia.bio/brahminy-blind-snake>, and Wikipedia <https://en.wikipedia.org/wiki/Indotyphlops_braminus#Common_names>. Likely to be present based on geographic location, but not yet confirmed.

BIMINI ISLANDS (Bahamas). A blog by Backwater Reptiles (9 July 2016) discussed Bimini blind snakes (*Ramphotyphlops braminus*) and their care, an apparent *lapsus* for *Typhlops biminiensis* (Richmond, 1955). Presently unconfirmed.

BIOKO (Equatorial Guinea). First listed by Mateo (2013), but unconfirmed.

COLOMBIA: Risaralda Province: Pereira: Cerritos-Sazagua, photographed by Thiago Benjumea on 29 July 2014 (posted on NaturaLista but now removed). This record needs to be verified; the posted photo was identifiable as a specimen of *I. braminus*. Also, listed for Colombia in Wikipedia <https://en.wikipedia.org/wiki/Indotyphlops_braminus#Common_names>, and cited for western South America (Pakenham, 1983) and northeastern South America (Tipton, 2005).

MARQUESA ISLANDS (French Polynesia). Probably present *fide* Ineich (2016), but unconfirmed.

RWANDA: Kiigali, reported by Crista Uwase on 10 November 2015 in RwandaWire (online news service). This is a possible but unconfirmed sighting of *I. braminus* as no photograph has been available to author.

SÃO TOMÉ & PRINCIPÉ: Hofer (2002) stated the possibility of occurrence. Listed by Mateo (2013), but unconfirmed.

SOCOTRA and/or YEMEN. First listed by Loveridge (1957), then Lever (2003), Kraus (2009), Wallach et al. (2014), Animalia website <http://animalia.bio/brahminy-blind-snake>, India Biodiversity Portal <https://indiabiodiversity.org/species/show/278705>, and Wikipedia <https://en.wikipedia.org/wiki/Indotyphlops_braminus#Common_names>, but unconfirmed.

ZIMBABWE. Listed by Animalia website <http://animalia.bio/brahminy-blind-snake> and Wikipedia <https://en.wikipedia.org/wiki/Indotyphlops_braminus#Common_names>, but unconfirmed.

Acknowledgments

Contact was attempted with all of the sources mentioned above who posted images or records online to obtain more complete details about their specimens but most were unsuccessful. I wish to thank the following people who did provide photographs and data on specimens that they had observed: José Carro (Puerto Rico), Andrew Dekker (Zambia), Sarah Magrath (Zambia), Steve Page (Costa Rica), and Karen Rawlins (Georgia). Numerous other persons, museums, online databases, and social media platforms also contributed to the project in general and they will be acknowledged in future publications on *I. braminus* distribution.

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MABI I'm Amazed! (Part 2 of 2)

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*As none of you will likely remember, last month the author regaled the readers of this publication with a tale of a nine-foot-long Sonoran Whipsnake (*Masticophis bilineatus*) [MABI]. I know full well how impossible that story is to believe. But the harder I try to convince myself that I must have done something wrong with my crude heel-to-toe measurement of this snake, the more I realize that I got it right. The snake was a whopper; the story is not. That observation was initially part of everything else that follows below. But a submission deadline, article length, and the incredible nature of the observation forced me to divide this piece into two parts. I did not entitle the March 2020 article as Part 1 because I was unsure when, if ever, I could write a Part 2. This particular column has been a work in progress since before I even had a monthly column!*

Upon seeing last month's "MABI I'm Amazed" *article for the first time, our beloved editor was inspired to say: "Thanks Roger, I'm sure that Paul McCartney would be proud of you for the title. Not sure that he'd believe you about the size of the whipsnake though."*

Our editor is such a wit. No Mike, I don't think Sir Paul would believe me about the size of the whipsnake. (Although I *would* be impressed if he knew enough about the subject matter to disbelieve me.) Nor do I think he'd be proud of me for the title, either. I'll be lucky if he doesn't sue my sorry ass! But before he does, I just want to say that his song "Maybe I'm Amazed" is a great love song, and a fine tribute to the nature of the true love and friendship that he felt for Linda. Every human ought to experience that kind of compassionate relationship at one point in their life. I'm happy for Sir Paul that he had the chance to feel it. And I did not mean to rip off Sir Paul with my title. The rip off—if that is what it was—was meant as a nod of respect to one of the greatest singers and songwriters in the world. And it is also a nod of respect to the entire *Masticophis* clade. (I think that Coachwhips and Striped Whipsnakes are also very cool snakes. But "MAFL" or "MATA" before "I'm amazed" doesn't cut it.) Meanwhile, I do love MABI. And the more I see of them, the more that they amaze me. What amazes me as much as MABI are the observations and photographs that are included in this article. Much of what follows could *not* be reported without the boots-on-the-ground effort of other local herpers. I am proud to call them friends and colleagues, and proud to add my own observations to theirs. Without further ado, ***we rock!***

There were many types of "life list" snakes that were found after I moved to Arizona. Many of these are burned so deep in my memory that I still have total recall about the dates and circumstances. For whatever reason, MABI is not one of those. The first several came and went without me being able to mentally conjure *anything* about them. Poof—they are gone, and can *not* be resurrected. There was a point in time that we *thought* that we were seeing so many MABI that we grew jaded with them. We encountered them while seeking the other "sexy" target species. With our focus being on what we considered to be more important, we began viewing MABI with disdain. We called them such things as "Sonoran Junksnakes," or "Snoring Junksnakes." We thought these derogatory names displayed great wit—but we were only half right with that notion.

As indicated in several past columns, I started my first herp journal in 1989. The first entry was 18 July of that year. From that point on, every snake and turtle encountered was documented, as were six species of lizards that I thought were cool. The first MABI to ever be documented thusly (and hence, never be *completely* forgotten) was on 18 August. That one was exactly one month into the process. It was the sixth entry made in my journal. And on and on the process continued, until finally, at the close of 1995, I thought it was high time that I start to synthesize what was documented in these-here / them-there notes of mine. To say the info was enlightening would be an understatement. In February of 1996, I gave a presentation to the Tucson Herpetological Society based on the results. The talk was entitled "Reptile Numbers and Activities within the Hundred Mile Circle." The presentation was very well received—which is always good—but the kudos paled compared to what I learned by preparing for that presentation. My own herpetological accounting taught me that venomous snakes far outnumbered their nonvenomous counterparts. I also learned that during these years, I had spent far more time in the field than even the most accomplished academic in the room. The randomness of these field trips, which were 848 in number, was also a factor in throwing some weight behind the numbers. In short, two out of every three snakes encountered had rattles at the end of their tails. (That 66% ratio has remained consistent to within a few percentage points every year since.) This revelation in turn suddenly gave me a new appreciation for the so-called "common" nonvenomous snakes encountered. In the presentation, I highlighted ten species of snakes found in the vicinity of Tucson. Five were rattlesnakes; five were colubrids. Please refer to Table 1 for the results of this 6½-year experience.

It would take an entire column to discuss these numbers in depth. But for this column, we speak only of the MABI, and how they relate numbers-wise to the other herps they share patches of ground with. Along with MABI and the other nine species of snakes that were covered in my presentation, I have included in Table 1 four reptile species that are protected in Arizona. These four are the species that we were actually seeking while encountering our "Snoring Junksnakes." These four species were protected for the very reason that we sought them. They have a certain cool factor, and thus are highly prized by collectors. And they are considered "rare." But like my particular group of friends, most people who seek them are not at all interested in collecting them. We seek only photos as our trophy. That is a distinction that those who make the laws do not

Table 1. Numbers of 14 reptile species encountered by the author within a 100-mile radius of Tucson, Arizona, during 848 field trips taken between 18 July 1989 and 31 December 1995. * = species protected in the state of Arizona.

Species	N
Western Diamond-backed Rattlesnake (*Crotalus atrox*)	529
Sonoran Desert Tortoise (*Gopherus morafkai*)*	288
Sidewinder (*Crotalus cerastes*)	273
Mojave Rattlesnake (*Crotalus scutulatus*)	125
Black-tailed Rattlesnake (*Crotalus molossus*)	110
Sonoran Gophersnake (*Pituophis catenifer*)	106
Long-nosed Snake (*Rhinocheilus lecontei*)	74
Rock Rattlesnake (*Crotalus lepidus*)*	71
Gila Monster (*Heloderma suspectum*)*	69
Coachwhip (*Masticophis flagellum*)	66
Sonoran Whipsnake (*Masticophis bilineatus*)	54
Ridge-nosed Rattlesnake (*Crotalus willardi*)*	49
Tiger Rattlesnake (*Crotalus tigris*)	44
Western Patch-nosed Snake (*Salvadora hexalepis*)	43

consider, and will probably never consider. In their minds, any person carrying a snake hook or tongs is a potential "bad guy." In any case, as the chart shows, three of the four protected Arizona species listed outnumbered the MABI! The most mind-blowing number of all was the fact that I encountered more Gila Monsters than MABI during this time period. (The two species often inhabit the same patches of ground.) While the information on this chart is admittedly dated, I consider these numbers to be more realistic and pure than anything that has transpired since. These were my glory years—my years of wonder, discovery and learning. As the years began to multiply, the skill sets learned through the trial and error of it all began to bias my efforts on how to seek only that which interested me the most. But through it all, despite learning that MABI encounters were far rarer than I had erroneously thought, *never* did I say to myself—then or now—"Gee, I want to go find a Sonoran Whipsnake today." They were, and continue to be, a snake that is randomly encountered while seeking other things. But thanks to synthesizing my numbers when I did, I have an entirely different point of view where encountering some of the species of snakes that are thought of as common and ordinary are concerned. They are *not* common, and especially where MABI is concerned, they are *not* ordinary!

While I can't remember the first several that I saw, I vividly remember the first one that I caught. As it came before I was documenting anything in writing, I can't give an exact date or time that it happened. I know for sure that I was in French Joe Canyon of the Whetstone Mountains, in the late spring of 1989. The year is only remembered because the incident happened just after I was promoted to Instrument Shop Supervisor for National Optical Astronomy Observatory (NOAO). And the only reason I remember the promotion to coincide with the observation is because I sprained my right ankle the day before my interview to get that job. And that sprained ankle was still bothering me in a big way the day that I locked eyes with that MABI. I don't know if the reader has realized what I just did in the process of trying to zero in on the date of my first MABI capture. I did the thing that *all* older people do. I went to great lengths to discuss with myself just exactly when a somewhat trivial event in my life happened. I can't tell the reader how many times when, as a younger man, I impatiently witnessed older folk in my life doing the same thing to me. The event that I would suffer listening through was usually something that I cared less than nothing about in the first place. On top of that, I would then have to endure the agony of hearing some old fogey debate himself over exactly when this particular topic of negligible interest happened. As this article developed, I was amazed at how quickly and accurately the particulars of any given event that was notated came to light. In short, I'm very glad that I got in the habit of writing things down. And I wish the rest of you would start doing the same!

Dennis and Jamara Caldwell were with me on this first MABI-capture of mine. It was their idea to bring me along for the ride, despite the ankle problem. The plan was that I would stay close to camp, and if I saw anything cool, I was to holler for them. They were well out of sight when my eyes beheld about a four-foot-long *dandy* of a MABI lying with head periscoped upward (see Figure 1). How I *love* that posture! It was lying in a lazy S-shape in a thick patch of grass that stood about six inches tall. The head was poised above the grass. It was looking in my general direction, but had not yet detected me. I was standing under the canopy of some convenient oak trees about 10 meters away. As these were the days that I still had the strong desire to capture and handle every nonvenomous snake that I saw, I was strategizing how to best get ahold of it. My throbbing ankle was screaming at me: "Don't do this!" Nevertheless, it was decided that an all out geek charge straight at the snake, followed by a diving grab, would be the best way to nail it. At my first lunge, the snake dropped and ran, flowing like liquid greased lightning through the grassy terrain of the expansive, downhill slope before it. I managed to gamely hobble along behind it at warp gimp speed (just out of diving range), all the while hollering for Dennis or Jamara to come and help me catch it. About halfway across the meadow, a spindly one-limbed catclaw acacia rose to the height of about one meter out of the grass. The snake jetted up that, and, using it as a springboard, actually went airborne for a split second as it tried to utilize its considerable momentum to

Figure 1. A Whipsnake in periscope posture. Image by the author.

Figure 2. After a wild chase, the author, helped by Dennis and Jamara Caldwell, was able to successfully capture this Sonoran Whipsnake (*Masticophis bilineatus*) [MABI hereafter in images]. Image by Dennis J. Caldwell, May 1989.

carry it into some low-lying branches of a mesquite that was directly in its path. The "leap" landed the snake on the lowermost edge of the branches—which were not strong enough to support it. The snake fell through, and belly-flopped to the ground with an audible thump. Missing its mark only slowed the snake down for an instant. It quickly ramped up to top speed again. Roughly 20 meters from the failed leap was yet another spindly little catclaw in nearly the exact situation as the first. But this time, the momentum actually landed the snake in the lowest branches of the oak tree in front of it. This time, the branches supported its weight. The snake then deftly jetted to the top of the tree, which was roughly 8 meters tall. I was left at the bottom—like a helpless hound that has treed something in a place that he can't go. I spent the next half-hour of my life loudly baying for Dennis and Jamara to come help. Eventually, the pair arrived, and Dennis nimbly climbed that oak to make the grab. At the time, I was not carrying a camera, and Dennis photographed me holding the prize. He tastefully focused on the snake, chopping my head out of the picture entirely (Figure 2).

This author lives for far more than serving our community as a herpetological accountant, or being a capture-happy raging bull of a geek herper. It is witnessing the truly incredible behavioral events in nature that float my boat. Where MABI is concerned, my observing has mostly been limited to "now you see 'em, now you don't" type of stuff. If one takes one's eyes off a fast-flying MABI, that will likely be the end of the observation. My intent with this column is to reveal not only my own eyewitness accounts of rarely-seen MABI behaviors, but those of others with whom I have worked closely through the years.

Where MABI is concerned, we start with reproduction. By far the most definitive work that I know of is Stephen Goldberg's treatise on them. There are many surprises to be found in Goldberg's exquisite paper. The biggest surprise of all was eight male MABI undergoing spermiogenesis in the fall. For September, there were 3 out of 5 undergoing the process, 3 for 3 in October, and 2 for 2 in November. The possibility for fall mating is one fortuitous observation away from becoming reality for this author. But as is common with other oviparous colubrids in Arizona, May seems to be the month for mating. Goldberg's work indicates that 8 out of 10 males tested were undergoing spermiogenesis in May. Ten out of 16 May females either displayed yolk deposition, enlarged follicles, or oviductal eggs. (All signs of being reproductively active; see Goldberg, 1998.)

My observations, be they ever so humble, are one incident of mating, one incident of a surface-active hatchling, and a wild gravid female that was captured for further observations. The MABI mating observation occurred on 2 May 2015. While we were seeking Arizona Black Rattlesnakes (*Crotalus cerberus*) in the Rincon Mountains, Marty Feldner found a pair of MABI in coitus (Repp, 2018: p. 196). The timing of Marty's find dovetails nicely with Goldberg's observations. Also on track with Goldberg's findings, on 20 May 2018 Robert Winward captured a gravid MABI in the Catalina Mountains, Pima County, Arizona, and brought her home. On 19 July, Rob's MABI oviposited two eggs and two infertile masses (slugs). The two good eggs hatched on 27 September. The other two good eggs (Rob and I) processed the hatchlings on 5 October. Both were males. Signs that they were about to enter their first ecdysis episode were noticeably apparent. The snout–vent lengths (SVLs) were 278 and 295 mm (10.94 and 11.61 inches). The total lengths for each were 403 mm and 416 mm (15.87 and 16.38 inches) respectively. Their masses were 8.5 and 9 grams. There is but one incident of the author remembering a MABI hatchling encounter in the wild. (There are likely more, but the one "for sure" is

Figure 3. (Left): A captive born MABI. (Right): a wild born MABI. In both images, the author's hand(s) are also portrayed.
Images by: (Left) Robert K. Winward, 5 October 2019; (Right) Edward O. Moll, 7 October 2000

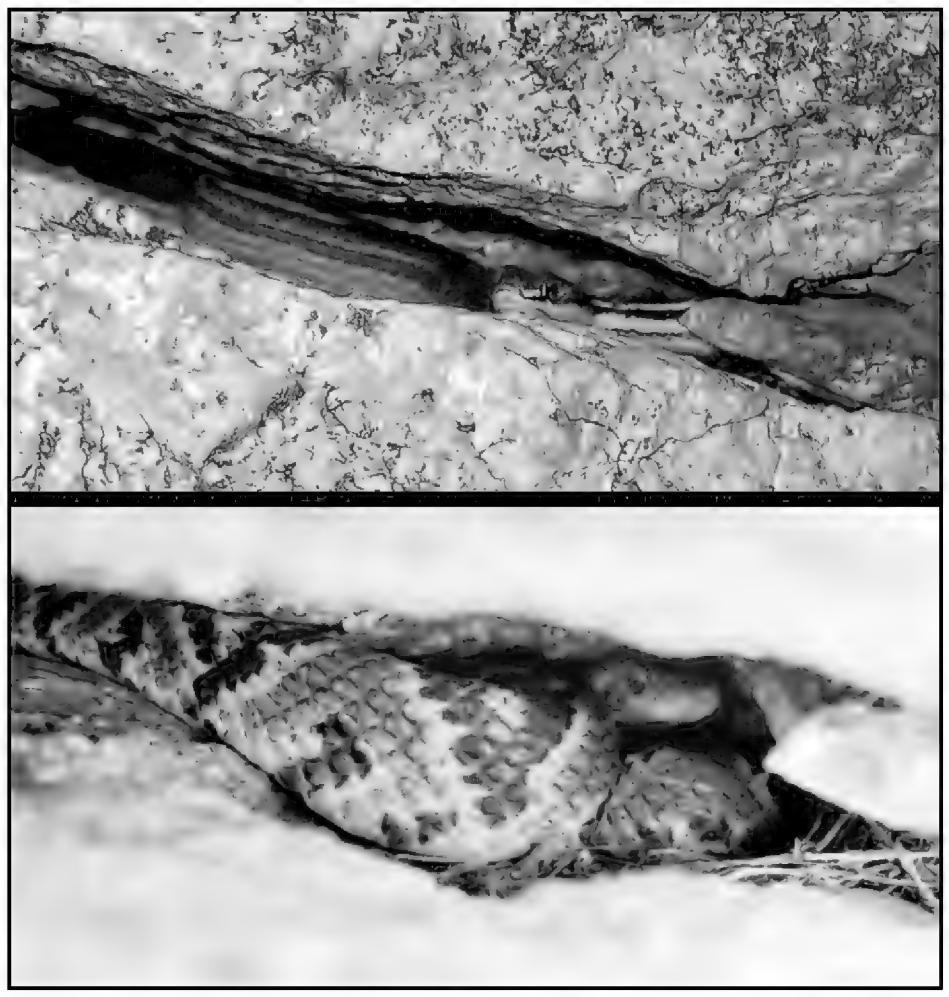

Figure 4. (Top): A MABI viewed in a well-known Western (Sonoran) Lyresnake (*Trimorphodon lambda*) crevice. The author has watched this lyresnake crevice since 1992, and was quite surprised with the MABI being found there. (Bottom): Lyresnake in the same crevice as above. Images by the author: (Top) 29 July 2006; (Bottom) 2 December 2006.

mentioned here). The hatchling encounter occurred when Ed "Killer" Moll was driving the two of us down a gravel thoroughfare that runs through the east side of the Rincon Mountains, Pima County, Arizona. I saw it all develop from my shotgun seat in his truck. The little MABI was at rest on the road, stretched out in a nearly ramrod-straight posture. It lay directly in the trajectory of the driver's side front tire. As soon as I saw it, I hollered "Ed—Whipsnake—look out! Doop!" My announcement came upon Dr. Moll's ears a split second too late, and was followed by: "Uh . . . would you mind stopping for that? I'll put it in the cooler for you." This misdeed occurred on 7 October 2000, at 0925 hours. I did not measure a snout–vent length for this one, but total length was 330 mm (13 inches), which is ~3 inches shorter than Rob's two hatchlings. But as the photo on the right in Figure 3 indicates, part of the tail (probably well over an inch) was missing. My guess at the sex of this snake was female, which may be another reason for the shorter length. This event, coupled with Rob's hatching event of 27 September, provides some evidence of a very late summer / very early fall hatching scenario (see Figure 3).

As this article develops, little known natural history aspects of MABI are suddenly leaping to the forefront of my brain. Most of these mini-epiphanies are being dismissed as fast as they develop. But I would do this effort with MABI a disservice by not including what is said next. One snake that is often found on the rocky hillsides that MABI inhabit is the Sonoran Lyresnake (*Trimorphodon lambda*). As one who often looks in rock crevices to find many species of herps, I have found exactly three MABI in crevices throughout the years. In all three cases, these crevices were known lyresnake cracks (Figure 4). I speculate that since MABI are ophiophagous, the MABI observed in these lyresnake crevices might actually have been after potential prey.

Besides the obvious difficulty in witnessing reproduction with snakes of any species in the wild, perhaps the next hardest behavior to witness is the simple act of feeding. Witnessing a snake eating something in the wild is not exactly as easy as feeding ducks in a city park. We might intuitively guess that MABI eat lizards, birds, eggs, rodents and snakes. This article covers all but birds and eggs. I'm always hopeful to tack on more and different feeding observations, as are my friends. But we gotta see it before we can report it!

It is downright comical to note that with the following six feeding attempts, there is not a single successful "down the hatch" incident to relay. In one of the six, the human observers were conscientiously trying *not* to intervene with the subjects involved. With the next four, the human observers meddled with the process. With the second-to-last, human interlopers caused a MABI to regurgitate a successfully ingested prey item. (*Up the hatch*!) And with the last downright sensational predation attempt, the MABI involved missed several opportunities to score a meal with four different potential prey items to choose from.

Taking the first five attempted feeding events in chronological order, on 5 June 1993 my constant sidekick Dennis Caldwell and I were exploring the headwaters of the Cañada del Oro River. The location of this magnificent and pristine canyon is in the northern Catalina Mountains, Pinal County, Arizona, at an elevation of ~5,500 feet (1676 m). As was often the case with the two of us, we became separated. I eventually viewed him across the distance of a meadow, and he was in a crouching position. He had his camera to his eye, and was quietly photographing something that I couldn't see. I had long before learned not to question such actions, or try to photo-bomb his efforts. I instead slipped up behind him and looked over his shoulder. When I saw that he was photographing an adult MABI with an adult female Greater Earless Lizard (*Cophosaurus texanus*) in its chops, I quietly slipped away—grateful that I did not disturb the situation (Figure 5). When we found each other again a little upstream, Dennis explained that the lizard had been fleeing from him when the MABI burst from out of nowhere to intercept her. As Dennis tried to get more photos, the snake fled with the lizard still in its mouth. While we can assume that the snake eventually choked down the lizard, we did not actually observe that happening.

I was not present for the three feeding attempts about to be described. But the subsequent images and/or written accounts of

Figure 5. MABI with a female Greater Earless Lizard (*Cophosaurus texanus*) in its jaws. Image by Dennis J. Caldwell, 5 June 1993.

these events, as well as knowledge of the personnel involved, lend enough credence to accept them all as fact. The first occurred 23 August 1997 in the Whetstone Mountains, Cochise County, Arizona. At the time, Peter Holm and Erik Enderson were part of a formal survey on the herpetofauna of that region (Turner et al., 1999). Enderson and Holm first heard a thrashing noise in a nearby oak tree, and saw something fall from the branches. Upon investigating further, they found a MABI in the process of swallowing a juvenile Black-tailed Rattlesnake (*Crotalus molossus*). The *C. molossus* was almost completely down the hatch of the MABI when first encountered. (Only the tail and rattle remained outside of the gullet.) I still question what happened next with every fiber of my being, but this was *their* party, and they did what they wanted. They wanted—and got—size data for both snakes. Peter separated the two snakes, both of which recovered. The MABI was 1679 mm (66.1 inches) total length, with a mass of 328 grams. The *C. molossus* was 371 mm (14.6 inches) in total length, with a mass of 22 grams. There can be little doubt that the MABI would have successfully swallowed the prey item had the observers let nature take its course. And as Enderson is an excellent wildlife photographer, I can only shake my head while screaming a silent "G-a-a-a" over the missed photo opportunity (Enderson, 1999).

The next incident involved a MABI and a Clark's Spiny Lizard (*Sceloporus clarkii*). On 15 September 2002, Bob Bezy and Erik Enderson were exploring Martina Mountain, which is the southernmost peak of the Roskruge Range, Pima County, Arizona. Upon investigating a commotion in a nearby boulder field, Enderson was able to photograph a MABI (~1 m total length) with the rear left flank of the *S. clarkii* grasped in its snappers. The snake dropped the lizard and escaped. The lizard was not quite as lucky, and wound up in the U of A collection of preserved specimens. The SVL of the lizard was 113 mm (4.45 inches) (Bezy and Enderson, 2003).

The last of the Repp-less observations, and by far the most interesting of the lot, comes from the camera and herpetological diligence of John Slone. On the evening of 16 September 2009, Mr. Slone was driving a network of paved roads in the southwestern Tortolita Mountains, Pima County, Arizona. At 2217 hours, he beheld an ~1.4-meter total length MABI that was attempting to ingest a rather large (estimating 120 mm SVL) Regal Horned Lizard (*Phrynosoma solare*). As John had neglected to bring his camera, he dashed back home to retrieve it. At 2259 hours, he found the situation as he had left it—both predator and prey were locked into a world of hurt. The MABI had attempted to eat the lizard head first. The spike-infested head of the lizard was stuck in the gullet of the MABI. The cranial horns of the lizard had penetrated the snake's postcranial tissues, and the snake was bleeding profusely. It was clear that without intervention, both the prey item and the predator were going to die. After taking several photos (Figure 6), Mr. Slone cautiously separated the combatants. The lizard was dead, but the snake slowly crawled off the road and into the desert. It is the sincere hope of this author that this particular MABI scratched horny toads off its list of menu items!

On the morning of 16 April 2019, Rob Winward and I were hiking up Deerio Canyon, which is located in the northern

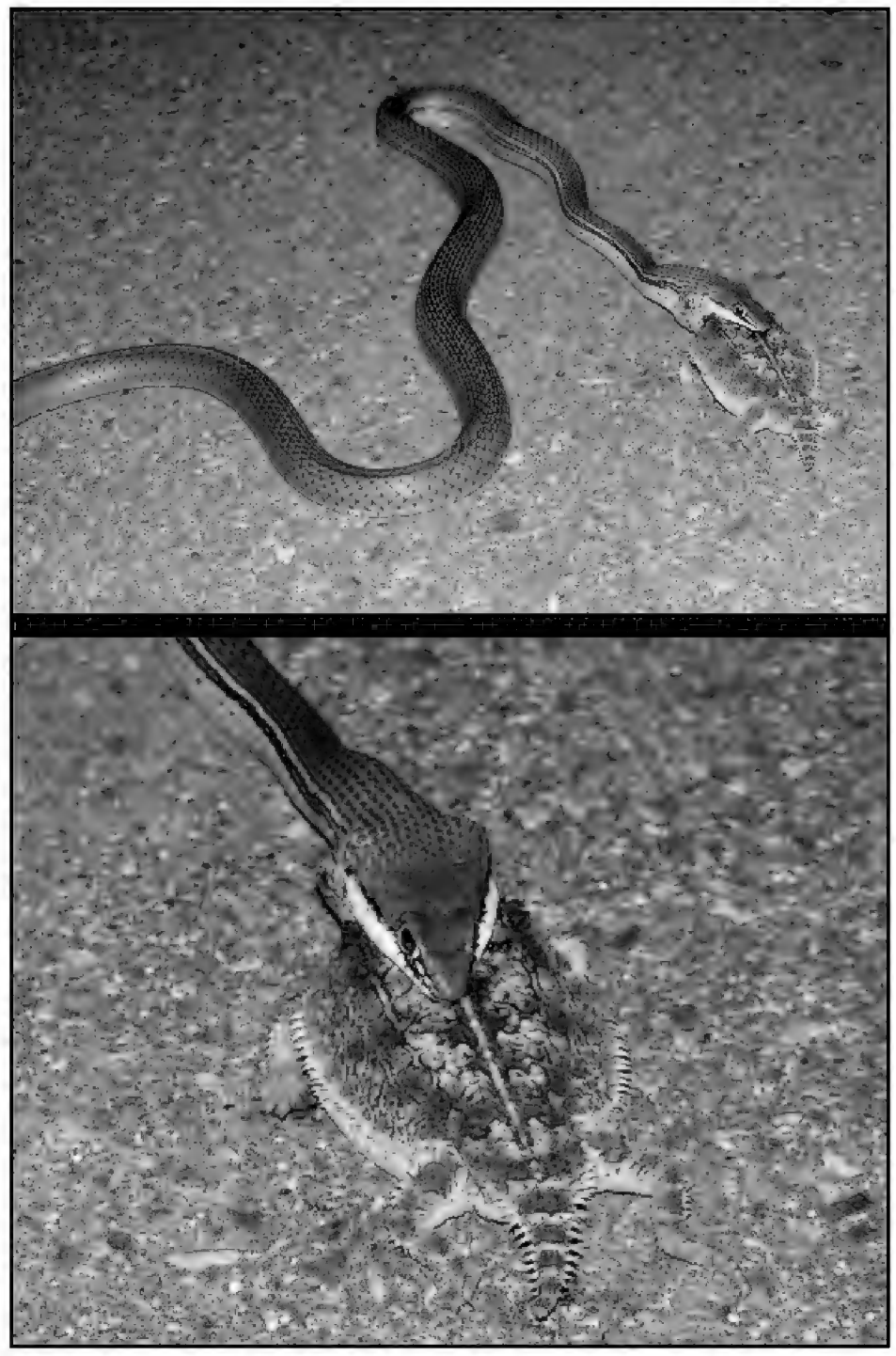

Figure 6. Two images depicting a failed attempt by a MABI trying to swallow an adult Regal Horned Lizard (*Phrynosoma solare*). Images by John M. Slone, 16 September 2009.

Tortolita Mountains, Pinal County, Arizona. Deerio Canyon is often the only canyon in the northern Tortolitas to maintain the constant trickle of an intermittent stream. It remains wet long after all the other nearby canyons go dry. At 1024 hours, I observed something that may have never been documented before. We speak of getting a drink of water. The snake was first viewed sprawled out in a long, lanky, lazy S curve. This MABI was a dandy, roughly 1.7 meters total length. The distal two-thirds of the snake was on the gently sloping embankment of the stream. The anterior portion of the snake was in damp sand, the contour of which gently inclined in a downward trajectory to the streambed itself. The neck and head of the snake were lying atop a slime-green carpet of algae. I first saw it before it saw me. It was perhaps 30 meters upstream when first viewed. The head was held just aloft of the algae-coated waters, and cocked slightly downward toward the same. The tongue was slipping in and out of the mouth to collect moisture from the top of the algae. (Why it didn't choose to drink from the clear pool of water one-half a body-length upstream of this particular pool is a mystery to me. I have observed lizards drinking from the mud beside puddles rather than going for the clear water less than an inch away. And many rattlesnakes viewed drinking seem to prefer to lap water droplets off their flanks as opposed to drinking out of puddles nearby. It's just one of those quirky things that the herps in the Sonoran Desert sometimes do.) The jowls

Figure 7. Image by Robert K. Winward, 16 April 2019, moments after this MABI stopped drinking water from an algae-coated pool.

of the snake were pulsating in and out at a rather brisk pace, indicating that the snake was indeed drinking. My very first image of this snake shows the head cocked downward—caught in the act! But as far as photos goes, it just doesn't cut it. About the time I was going to try another photo, Rob rounded the bend behind me. This put the snake on full alert. I kept firing away anyhow. Rob noted the situation, and did his best to hide behind me while he slowly and stealthily advanced beside me. A brief huddle ensued between the two of us, and we decided to let Rob move in ahead of me to try his luck with his camera. (Like everybody else, Rob is a better photographer than me.) The snake cooperated nicely for most of Rob's advance. Other than the initial slight upward inclining of the head, it remained in place until Rob got right up on it (Figure 7). It then tried to flee, but Rob grabbed it. There next ensued a dance session between Rob and the snake. The "MABI dance" is one that anybody who has ever grabbed a large Whipsnake of any kind will be familiar with. The snippy MABI kept launching rapid-fire strikes at Rob's feet and bare legs, which Rob managed to avoid by nimbly hopping about. There was a whole lot of moving going down with both parties involved, coupled with a highly amused string of cajoling and insults from the mouth of this author. Rob finally got a grip behind the head of the snake, and got it under control. During the capture process, the MABI regurgitated a freshly ingested young adult (~75 mm SVL) whiptail (*Aspidoscelis* sp.). The tail of the lizard was broken, and it too spewed out of the gullet of the snake. The two distinct pieces of freshly-puked lizard were gathered for some photos (Figure 8). We eventually let the snake go, and since Rob was collecting lizards from the canyon to feed his captive snakes, I assumed that he would also take the whiptail. That proved to be a lame assumption. We continued up the canyon until such point as what went up had to come back down. I was ahead of Rob as I passed the place where the photography of the whiptail had occurred. It came as no surprise to note that the lizard was gone. It was not until several days later that I thought to ask Rob if he had taken that lizard. He had *not*! The world will never know whether or not the MABI returned to claim its prize—but one can hope! (Truth be told, that is an unlikely scenario. A puked whiptail proudly perched atop a boulder in the middle of a wash was probably snapped up by any number of predatory species within seconds of our departure. A free lunch does not last long in the Sonoran Desert.) Speaking of things that the world may never know, the image (Figure 8) of the regurged whiptail has created quite a stir with four local *Aspidoscelis* experts. After much back and forth

Figure 8. Whiptail regurgitated from the gullet of the MABI in Figure 7. Four experts are confused as to the exact identity of this lizard, so we shall list it here as (*Aspidoscelis* sp.) Image by author, 16 April 2019.

discussion, they *know* what it is *not*. They don't know what it is! One thing is sure, they are mystified (and more than a little bit disappointed) that I did *not* collect it for them. Once again, I've blown the chance at fame. The "Roger A. Repp Whiptail (*Aspidoscelis rogerreppi*)" went down the gullet of some miserable scavenger, morphed into a scale-infested zinger, and is now reduced to few grains of sand in remote wash in the middle of nowhere. And I had the slimy thing right in my hands!

Before proceeding with the last tale of MABI behavioral excellence, we return to the usual "now you see them, now you don't" type of observations that are the norm where MABI are concerned. As highlighted in Figure 1, they have very large eyes. There can be little doubt that they see very well. Coupled with that good eyesight is their ability to escape. Their combination of color and speed is such that they just seem to vanish in plain sight as soon as they start moving. It is interesting—and more than coincidental—to note that each of the six observational highlights of this article slowed these alert and fast-moving snakes down enough to allow the authors of each event to have something to share. And they all involved either food or water—or both. This last observation is the all-time champ for a whipsnake that was definitively *not* a "now you see them, now you don't" type of observation.

It all started with a chair, and a beer. Until recently, all of my observations on everything herpetological involved active participation of observer-to-herps. I have used three methods for doing this. Number one is road cruising. Whether by night or day, one must drive a vehicle to get there. Number two is boots on ground. One hikes into the thick of the habitat to observe something cool. Number three involves the first two, but I consider it the lowest form of herping. We speak of flipping ground cover—be it rocks or boards—to gain access to a visual. Any *idiot* can turn something over and find a prize. I know this to be true, because I do it often. But the long and short of all three methods is this: If one enters the world for long enough, one sees the world. But what if one stays still? Will the world come to the observer? My friends, I am here to tell you that sometimes it does! Hence, a fourth method of herping will be forever part of my arsenal to use in my personal approach to herping. I call it the "relax, drink and wait" method.

This observation began at 1055 hours on the morning of 12 August 2017. The ambient air temperature was 29.5°C (85°F), the cloud cover was 10%, humidity was 53%, and the breezes were mild. Our location was somewhere on the east side of the Rincon Mountains, perched directly on the boundary line between Pima and Cochise counties, Arizona. The elevation was ~4,000 feet, and I had just finished my short hike into the oak woodlands that harbor the greatest of all rattlesnakes, the Arizona Black Rattlesnake (*Crotalus cerberus*). Marty Feldner was with me this day, but he was not with me when I first returned to my truck. We had started our hike at 0900 hours, but I made the mistake of leaving my rain gear in the truck. A rapid storm blew in, resplendent with lightning, thunder, black clouds and howling winds. By the time I returned to the truck, the storm had retreated—without so much as a drop of rain falling. It was soon to become insufferably hot. Somewhat dejected by the course of the storm (a *far* better scenario would have been a brief downpour, followed by partly cloudy conditions), I dragged a chair out of the bed of my truck, as well as a green bottle of double X. Through a process best described as more luck than brains, I positioned my chair to be aiming in exactly the right position to view whatever might come my way. (Rule #1 of "relax, drink and wait herping": Have your chair aimed in the proper direction). Presently, or much later—depending on one's perception of time—Marty also returned. At precisely 1120 hours, he plopped his chair beside mine, and cracked open a favored elixir of his own. It was a thick brown beverage of sorts, looking not unlike the stuff one might pour on a pancake. We compared notes. The results were modest, and not worth creating the case of carpal tunnel syndrome required in order to type the dictionary of Latin required to recount them. The bottom line: no *cerberus*. Marty settled in, but did not have long to enjoy the moment. Before going any further in the narrative, the author invites the reader to study the image in Figure 9. You are looking at an oak tree. So were we. The dimensions of this oak are roughly seven meters tall by ten meters wide. Roughly half of this oak is dead. That would be the half on the left of Figure 9. Nearly all the action about to be relayed occurred on and inside that far left trunk, which stands roughly 3.5 meters tall, and is hollow. There are several entrance holes leading into—and out of—said hollow portion. Of course, at the beginning of the observation, we were not aware of any of this. We were barely aware that there was a tree in front of us.

At precisely 1124 hours, a young packrat (*Neotoma sp*) was viewed scurrying up the far left trunk of that oak tree, and over the top. A split second after that, a large adult (~120 mm SVL) Clark's Spiny Lizard (*Sceloporus clarkii*) scurried up that same trunk, and gave pause near the top. And a split second after that, an ~1.5-meter total length MABI glided up that same trunk, perhaps in pursuit of that *clarkii*. The *clarkii* saw it coming, and jetted over the top of the trunk—seemingly on the same trajectory as the packrat. As soon as the *clarkii* vacated, the MABI's head arrived at the location where the lizard had given pause. The MABI then froze in place as its chemosensory instincts took over. The tail and body remained anchored in place, while the anterior 150 mm (6 inches of head and neck) began to nervously pour over and over the place where the *clarkii* had given pause. For several minutes, all the snake did was put his nose to the

Figure 9. Oak Tree where a MABI was observed for over 1.5 hours. For the entire time the snake was actively hunting, and at times, actively pursuing four different prey items. The dead limb on the left of this image is where most of the action transpired. Read text for more details. The images in Figures 9–12 are all by Martin J. Feldner, and all four were taken on 12 August 2017.

bark, and rapidly "taste/smell" every inch that the *clarkii* had previously occupied. The movements of the snake's head could best be described as twitchy—to the point of being downright spastic in appearance. The snake was obviously highly excited, and it is the opinion of this author that the snake would have been far more successful had it relied on eyesight rather than the chemosensory tongue-flicking to locate and snag any one of the four prey items about to present themselves. It was at this point that Mr. Feldner stood up, grabbed his beer (he knows what is important) and camera, and began his cautious approach. The plan was that I would stay put, while Marty—who is the better photographer—would try to move in for pictures. This one-two punch became highly effective in the time period to follow, for we had to be watching all sides of that oak tree at once to catch it all. I rely heavily on the time stamps of Marty's photos, as well as my own notations, to do my best to record the melee that was about to transpire.

Said melee began when the snake went over the top of the tree trunk previously described. Marty had swung around the opposite side of the tree to try to see what was happening, but he saw nothing. While he was seeing nothing, all hell was breaking loose on my side of the tree. First one *clarkii*, then another, came scurrying out of a hole to my right-hand side of the trunk, roughly 1 meter below the top. They both alertly gave pause in a side-by-side fashion at a hole in the left side of that trunk, which was slightly below the contour of the right-side opening that they had just exited. Had Marty been on my side of the tree, the picture of the two nearly equal-sized adult *clarkii* lined up with their heads swiveled to the right to intently watch their egress hole would have been an impressive addition to that which the reader is now seeing. And so would the image of that packrat emerging from the same hole and swinging around to Marty's side of the tree. The conversation between the two of us went something like: "Hey Roger! The *Neotoma* is on my side of tree now—whoops—he gone!" "Hey Marty! I got two *dandy clarkii* over here! No, wait, here comes something else! WTF—oh, it's a ground squirrel." "Yeah—I see him—he's over here now!

Figure 10. The MABI emerges from a hole in the lefthand trunk of the oak. Note the Rincon Mountains in the background.

Well, no he isn't! He gone too!" "Hey Marty! Here comes the whipsnake again!".

Yes, things were alternating in rapid-fire succession with both of our worlds. The last of the potential prey items to enter the arena was an antelope ground squirrel (likely an *Ammospermophilus harrisii*)—and GOODNESS GRACIOUS look at the Latin on *that* insignificant little fleabag of a snake snack! I'll be calling this little vermin "AMHA" from this point on in the narrative. As the snatch of conversation just revealed between Marty and me would indicate, the AMHA emerged from the getaway hole just ahead of the snake. As soon as the two *clarkii* saw the snake emerge, they both scrambled into their chosen escape hole. The snake detected the motion, and glided in behind them. For the moment, everything was out of the sight of both of us. Marty was now standing on the left side of the tree, his perspective was roughly 90° to the left of mine. Suddenly, like a shot out of a cannon, the AMHA leapt from the top of the dead trunk of the tree. Its trajectory carried it right toward Marty's head, and he deftly cocked his head to the right in order to avoid getting a face full of flying rodent! The miserable little verminous swine hit the ground behind Marty on the run, and for the moment, the pestilent little turd-knocker with the overly long name was safe. One can only hope a hawk nailed it shortly thereafter. Whatever! It was thankfully out of this observation, as more verbiage than is necessary was already spent simply spewing the Latin name for it. Good riddance! While I vaguely remember one—more likely two—packrats scurrying about hither and thither on the action-packed limb, exact details were not notated or remembered. Hence, we write *them* out of the observation as well. Good riddance again! But as future events were to prove, at least one of the c*larkii* was still in the game.

The snake eventually emerged again from yet another entrance / exit hole in the tree trunk. The time that this happened was 1146 hours (Figure 10). We were now 22 minutes into this observation. From that point until the next interaction (1146 to 1220 hrs), the MABI spanned the entire length and height of the oak tree. At one point, it was all the way out beyond the frame of the photo. The crawl speed while it went up and down all the trunks, and to and fro to the very edge of the branches, could best be described as leisurely efficacious. At no point did it stop moving. It kept a steady and determined pace while continuously slithering about. It was searching for—what? Once again, it is my opinion that it was using its chemosensory skills to try to zero in on whatever it was trying to zero in on. The massive trunks and branches on this tree must have been a smorgasbord of small game trails, and the snake seemed to be checking every last one of them out. It eventually swung back to that left hollow trunk again, and entered it. Within seconds of it slipping out of sight, a *clarkii* emerged from the same hole as the pair had come out of earlier. It gave pause at the same hole that they both had retreated into earlier. Once again, the MABI emerged from that same hole. My notes indicate that it was exactly 1220 hours when what follows next happened: As the snake crossed the span of ~600 mm between it and the *clarkii*, it did so very slowly. It was creeping along, tongue-flicking all the way, hot on the fresh scent trail the lizard had just left. When the snake got to within an inch of the lizard, I thought "Oh, boy! Here we go!" But instead of snatching the motionless lizard, it kept inching slowly toward it until its snout actually touched it! And even after that, the snake had well over a second to latch onto it. (At this point, I'm screaming "*nail it you stupid sunovabitch!*") The *clarkii* then just dropped off the trunk and hit the ground with a plop. The snake followed at the same moment, and was actually snapping at it in midair on the way down. I estimate the distance that both dropped to be 2.5 meters. It was a prey-predator plunge, as it were. One moment, the snake is wearing that lizard as a hood ornament, and the next, it is diving over eight feet downward, trying to try to snag it in midair! What an *idiot*!

In order to get the people involved back into the scene, we backtrack a bit. My notes indicate that at 1155 hours, we "rested." Since I was resting the whole while, I assume that means Marty rested. There was a lot going on here, and I confess that I was snake watching, and *not* Marty watching. It is my best guess that Marty sat beside me until the double-drop of predator and prey occurred. My notes are very specific about the time that happened: 1220 hours. Whether Marty was standing or sitting at that time is unclear. The fact that there is no image of the MABI nuzzling the *clarkii* probably indicates that he was sitting with me at the time. While that would have made the angle perfect, the distance (~25 meters) may have been less than optimal. In any case, following the prey-predator plunge, Marty was back on it. The snake was swirling about on the ground looking for the lizard, but had no luck in locating it. Thanks to the time stamp on Marty's camera, we know that at 1126, the MABI was still on prowl for that *clarkii* (Figure 11). We also know that by 1231, the snake had aborted the ground chase, and was heading back up the tree. (Figure 12). Once again, that MABI did a full up patrol of the entire oak tree under description. It was still cruising that tree at 1300 hours, when we moved on. Our desire to try to find a *cerberus* overrode all common sense by doing so. And we got exactly what we deserved—*nothing*!

In closing the book on MABI for this publication, it must first be said that I'm not closing the book at all! I am throwing it wide open. I want to see *more* of this fantastic species of snake in action. And by the time this article is in the hands of the reader, it will be prime time in MABI-land. The time has come for me to earnestly start seeking them. Why? Because they are

Figure 11. At 1220 hours, 56 minutes into the observation, the MABI dropped 3.5 meters (over 8 feet!) while in pursuit of a Clark's Spiny Lizard (*Sceloporus clarkii*). This image was taken six minutes after the plunge.

Figure 12. The MABI aborts the ground search for the fallen *S. clarkii*, and returns to arboreal hunt. When the observers left at 1300, the snake was still actively hunting in that tree.

nice on the eyes—downright elegant! Their sleek, elongate dull grey to olive drab to turquoise dorsum is tastefully accentuated by cream-colored lower flanks, the color which morphs into glossy white on the head and chin. The glossy white venter head colors expand upward to stop just short of those large, doll-like eyes. They are found in the places that I like to go the most—the oak woodlands, which remind me so much of home. Even when ignoring any talk of nine-footers, they *do* reach an impressive size. Add to that their ground-hugging speed, coupled with their ability to so effortlessly glide arboreally, and we have a full-packaged, exciting-to-watch species of snake. While most would consider them common, ordinary, and hardly worth looking at, my experience teaches me otherwise. Very little is known about them, as this article demonstrates. And nothing can beat their demonstrations of behavior when they choose to exhibit some. In short, when it comes to the Sonoran Whipsnake—MABI I *am* amazed!

This here is Roger Repp, signing off from Southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are all above average.

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Herpetology 2020

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

REPRODUCTIVE BIOLOGY OF *BOTHROPS ATROX*

K. M. P. Silva et al. [2019, Herpetologica 75(3):198-207] note that reproductive seasonality is common among snakes, with mating, pregnancy, and birth or oviposition occurring only during few months of the year and modulated mainly by two environmental phenomena—temperature and rainfall. Species of *Bothrops* inhabit regions with varied climatic conditions, including those that are tropical, subtropical, equatorial and semiarid. *Bothrops atrox* is an endemic and widespread species of the Amazon rain forest. Such habitat is characterized by an equatorial climate with little variability in temperature and humidity, but marked seasonality in intense precipitation. The authors investigated several aspects of the reproductive biology of *B. atrox*, including the reproductive cycle, the sexual segment of the kidney (SSK), sperm storage, and the possible influence of temperature and rainfall on pregnancy duration, birth and spermatogenesis. Specifically, they examined museum specimens to describe sexual dimorphism, litter size, and male and female urogenital cycles through macroscopic and histological analyses. Females of *B. atrox* exhibited follicular recrudescence mainly from January to April (part of the wet season). Pregnant females were found throughout the year (except May), but births were found to occur mainly at the end of the dry season (August–October). Males exhibited SSK hypertrophy and sperm production in the wet season (November–April). Females were found to be larger than males, but males of *B. atrox*—as with other members of the *B. atrox* species complex—obtain relatively larger body sizes when compared with other species of *Bothrops*, which might be an adaptive response to male–male combat in this species. Together, these results show that *B. atrox* from Amazonia has a unique reproductive strategy (for each sex) among pit vipers, indicating greater reproductive plasticity when compared with its congeners.

Minutes of the CHS Board Meeting, March 12, 2020

John Gutierrez called the meeting to order at 7:35 P.M. Board members Rich Crowley and Jessica Wadleigh were absent. Minutes of the January 17 board meeting were read and accepted.

Officers' reports

Treasurer: John Archer briefly discussed the December and January financial reports. John promised that a February report would soon be available. We need to find out what ZooMed wants us to do in regard to the ReptileFest sponsorship that they have already sent a check for. Frank Sladek will try to find out.

Media secretary: Annalisa Kolb has received questions from new members wanting to confirm receipt of membership. Mike Dloogatch will inform Annalisa of new members so she can send out a welcoming email. Annalisa raised the possibility of canceling the print publication of the *Bulletin* and moving to only digital publication.

Membership secretary: Mike Dloogatch reported a slow increase in membership over the past six months.

Sergeant-at-arms: Mike Scott reported 56 people at the general meeting in February.

Committee reports

Shows: Gail Oomens sadly reported that per the governor's mandate due to the coronavirus pandemic all shows have been canceled until further notice.

ReptileFest: After much discussion John Archer moved to cancel ReptileFest until 2021. Mike Dloogatch seconded the motion, which was unanimously approved.

Adoptions: John Archer moved to reimburse Tom Mikosz $120 for a veterinarian bill for the sick bearded dragon he took in for the CHS. Mike Scott seconded the motion, which was approved unanimously. Further discussion of adoptions was tabled until adoption chair Zorina Banas can participate.

Junior herpers: Frank Sladek said that the March 8 field trip had a great turnout—well over 40 people. Didn't find any salamanders, but did come across the first garter snake of the year.

Library: Over the last year Joan Moore was able to purchase new books every month, building our library collection. John Archer moved to allocate up to $500 to the library in 2020. Tom Mikosz seconded the motion, which was unanimously approved.

Grants: An online vote took place on February 20, 2020. Mike Dloogatch moved to allocate $6000 for the 2020 grants program. Rich Crowley seconded the motion, which was approved (8 members voting yes). The list of grant recipients appears in the March *Bulletin*.

New Business

Each new board member will be given an @chicagoherp.org email address.

John Archer moved to reimburse Tom Mikosz for the $65 veterinarian bill due to his bearded dragon being injured at a show. Annalisa Kolb seconded. The motion was unanimously approved.

The meeting adjourned at 11:04 P.M.

Respectfully submitted by recording secretary Gail Oomens

Advertisements

For sale: **highest quality frozen rodents**. I have been raising rodents for over 30 years and can supply you with the highest quality mice available in the U.S. These are always exceptionally clean and healthy with no urine odor or mixed in bedding. I feed these to my own reptile collection exclusively and so make sure they are the best available. All rodents are produced from my personal breeding colony and are fed exceptional high protein, low fat rodent diets; no dog food is ever used. Additionally, all mice are flash frozen and are separate in the bag, not frozen together. I also have ultra low shipping prices to most areas of the U.S. and can beat others shipping prices considerably. I specialize in the smaller mice sizes and currently have the following four sizes available: Small pink mice (1 day old—1 gm) , $25 /100; Large pink mice (4 to 5 days old—2 to 3 gm), $27.50 /100; Small fuzzy mice (7 to 8 days old—5 to 6 gm), $30/100; Large fuzzy mice / hoppers (10 to 12 days old—8 to 10 gm), $35/100 Contact Kelly Haller at 785-224-7291 or by e-mail at kelhal56@hotmail.com

For sale: I have been raising boas for over 25 years and take exceptional care of them. The blood lines run from true Colombian *Boa constrictor imperator*. They are eating high quality frozen rodents that are bred here at our facility. I have 1 male Sharp Albino Sunglow Het Anery for $350 and 1 male Aztec Jungle 100% Het Sharp Albino for $300 (photographs available on request). Contact Angie at: angelasklyar@yahoo.com

Line ads in this publication are run free for CHS members—$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to mdloogatch@chicagoherp.org.

NEW CHS MEMBERS THIS MONTH

Robert Brightman
Zoe Levitt
Anthony Riportella

UPCOMING MEETINGS

The April 29 meeting of the Chicago Herpetological Society has been canceled.

The May 27 meeting has not yet been canceled, but it probably will be.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? The next board meeting will be held online sometime in May. If you wish to take part, please email mdloogatch@chicagoherp.org.

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